## *1) Phase Noise:*

This is a very important requirement for satisfactory operation given the low Baud rate and sensitive 8-PSK modulation used. We do not think the changed specification is an improvement, although it is a move to the type of specification that is simpler to measure with a COTS phase noise measurement tool.

For a start, we share Microcoms' concern about the effects of low frequency 'flicker' phase noise ($1/f^3$ overall slope, i.e. –30dB/decade) on the operation of demodulators. In this context, the original PLL based specification was very good as it accurately reflected the real-world needs of this performance specification. Any new measurement must cover, or have allowed for, disturbances down to very low offset frequencies (i.e. less than the typical demodulator tracking bandwidth).

Secondly, we do not see any good reason for having different measurements for the two GOES HDR Baud rates, and then a 3rd if 100 Baud international DCP, etc, is included!

We, and probably most other DCP manufacturers, use a single design of reference oscillator and synthesizer to cover all DCP modes of operation, so there is no difference in design and we see no advantage in having to test in different ways for certification.

We suggest keeping the original PLL based requirements, but allowing for such a test to be performed by other means as appropriate.

**We offer a suggested phase noise spec along the lines of:**

> **The phase noise should result in less than 2.0° RMS when measured with a 2nd order PLL having a DSB noise bandwidth of 20Hz (from a combination of 0.7 damping factor and 3.011Hz natural frequency) when measured using an RMS meter with a bandwidth of 2kHz. (see PLL diagram similar to prior versions)**
>
> **Alternatively, the phase noise should result in less than 2.4° RMS when measured by integrating the double sideband phase noise power. This may be also be performed by measuring the phase noise spectrum from 2.0Hz to 2.0kHz .**

Comments:

By having different integration ranges in the proposed change to 4.4.1, it actually would yield ***more*** transmitted phase noise for the 1200bps case when compared to the original PLL loop BW method found in the current specification. The actual allowable phase noise for the 300 bps will now be ***less*** than the existing 2 degrees. By integrating over the 2 to 2K range, the values are much closer to the original specifications as defined in prior cert specs, and more importantly, more consistent in value.

Finally, some clarification is needed in that Microcom looks to be proposing a PLL measurement system although the 'Loop Bandwidth' would appear to be the natural frequency in the provided comments. To completely define a 2nd order PLL we need to know both the natural frequency and the damping factor. The term "bandwidth" has too many interpretations to be unambiguous

(e.g. it has been used to refer to: the -3dB frequency response point, the natural frequency, the single-sided noise bandwidth, the two-sided noise bandwidth, etc)

The revised limits of 1.6Hz-150Hz are reasonably close to our suggestion of 2-2kHz (not very surprising given the majority of noise power is determined by the lower integration limit), but the 'integer' 2Hz value of our suggestion is probably easier to use in COTS equipment. Also we consider the use of two measurement limits for 300 Baud and 1200 Baud (6.2-600Hz) as unnecessary

Regardless, it appears that the proposed change leads us away from a PLL measurement proposed by Microcom to an integrated spectral phase noise measurement based on the wording.

Under all conditions, the specification should be worded to allow for any type of measurement and any effort to support COTS equipment should be made, which in this case, the spectral integration over a "whole number" of 2 Hz to 2KHz range would be valuable.

## *2) Encoder Flush and Turn-Off Time*

We agree with the concern expressed by Signal Engineering concerning the turn-off time specification, however, this is also applicable to the carrier preamble turn-on time.

Both should be specified in some sensible way, and they should be controlled (e.g. using the normal modulation filter from/to the -30dB or similar, or some other technique) so that turn on/off is not responsible for short bursts of wide spectral interference.

## *3) General Comments*

We believe the following should be considered as goals for the certification process:

1. All specifications should be directly relevant to correct operation of the system.
2. The certification requirements should only define the necessary performance to meet the goals of (1) and not any mandatory technical solution. The use of suggested methods, clearly indicated as such, is acceptable to provide guidance to manufacturers.
3. It should be possible to perform all of the required tests on "commercial off the shelf" (COTS) test equipment from companies such as Agilent, Anritsu, Rhode & Schwartz, etc. Where specific technical goals are non-standard, it should be defined as far as possible in terms of the result of standard tests (for example, see the phase noise comments above).
4. If a test is so specific to the DCP system that standard equipment cannot perform it with any reasonable effort, there should be more than one supplier of any specialized test set up that is accepted by NOAA.
5. All tests should be possible without any modification of normal DCP operation, except perhaps for phase noise testing where a reasonable period of carrier-only transmission is necessary. Disabling of the safety time-out should not be needed, or operation beyond this time period where thermal consideration (e.g. oscillator drift without GPS adjustment, etc) are beyond normal DCP operation.